Ms. Donna R. Searcy
Federal Communications Commission
1919 M Street, N.W. - Room 222
Washington, D.C. 20554

September 29, 1992

Re: **Comments of International Mobile Machines Corporation (IMM) in CC Docket 92-115.**

Dear Madam Secretary:

Transmitted herewith are an original and four copies of IMM's comments in the above referenced proceeding.

If you have any questions with regard to this matter, please do not hesitate to contact me.

Sincerely,

Jack Taylor

Jack Taylor, Esq.
International Mobile Machines

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Revision of Part 22 of the Commissions Rules Governing the Public Mobile Services	)	CC Docket No. 92-115
	)	
	)	

COMMENTS OF INTERNATIONAL MOBILE MACHINES

I. INTRODUCTION

International Mobile Machines ("IMM") respectfully submits these comments in the above captioned proceeding. IMM is a wireless technology manufacturer that has developed an advanced, spectrum efficient digital radio system currently in use providing wireless loops between telephone central offices and customer premises. The system, called the Ultraphone, is based on digital Time Division Multiple Access (TDMA) techniques which allow multiple users simultaneously to share a single radio channel. The service is provided by telephone companies under the Commission's Basic Exchange Telecommunications Radio Service (BETRS) rules* governing radio in the local loop. BETRS is provided primarily in rural areas. In these areas, frequency availability and favorable radio vs. wire economics encourage

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* 47 C.F.R. Sec. 22.600

the use of radio. BETRS is not available in urban areas.

II. DISCUSSION

In this Notice of Proposed Rulemaking (NPRM), the FCC proposes to revise Part 22 of the rules governing Public Mobile Services. Included in the FCC revisions are several proposals which, if partially modified, could provide significant benefits to telephone company provision of basic exchange telephone service in rural areas. These changes are technical in nature and are intended to reduce the interference potential between BETRS use of the two-way channels at 450 MHz and one-way paging use of the same channels in rural areas. Absent these changes, the already crowded channels at 450 MHz will become increasingly hostile to the provision of BETRS.

The technical proposals are meant to alleviate somewhat the potential for interference caused by paging use of these channels in rural areas. However, more extensive policy changes are required to ensure that the growing use of 450 MHz two-way channels by paging services in rural areas doesn't preclude the growth of BETRS service in rural America.

C. BETRS SERVICE IN RURAL AREAS IS JEOPARDIZED BY THE INCREASED USE OF TWO-WAY CHANNELS BY PAGING.

The FCC authorized the establishment of the BETR service in January 1988.* In the BETRS Report and Order, the Commission authorized co-primary access to both the 450 and 150 MHz bands in the Rural Radio Service and added 50 channels, at 800 MHz, from

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* See Report and Order, CC Docket No. 86-495, 3 FCC Rcd 214 (1988).

the Private Radio Service. The petitioners, at the time of the Report and Order and in subsequent reconsideration petitions noted that the 150 and 800 MHz co-primary allocations would be of little use for BETRS service for several reasons:

o There was no advanced digital radio equipment designed specifically to be integrated into the telephone network available in these bands to provide the service, as is the case in the 450 MHz band.

o There was no expression of interest by any manufacturer to provide such equipment. As a result, the only way to use these bands would be to jerry-rig commercially available analog mobile-radio equipment in order to provide radio-based dial tone within the telephone network.

o The restrictions on the use of 800 MHz band within 100 miles of the top 50 MSA's and the high occupancy rate of 150 MHz in rural areas made these bands useless, regardless of equipment availability.

Experience has borne out the forecast of the petitioners. The primary frequencies used for BETRS today are the 26 shared frequencies in the 450 MHz band; however, increased paging use of these frequencies increases the potential for interference and restricts BETRS growth and expansion.

For example, in one state alone -- Texas -- there are nineteen documented occurrences of BETRS facilities not being constructed in rural areas due to lack of available frequencies. In addition to these documented cases, there are the hundreds of other opportunities to use radio as a more cost effective media for providing basic telephone service that were not taken to even the planning stage because growth beyond the initial installation was impossible without adequate spectrum.

This last category, adequate spectrum for future growth, represents the major obstacle to the use of radio in the rural

local loop. Paging use of the scarce 450 MHz paired channels in rural areas contributes to this condition.

The result of this unrestricted use of the 450 MHz channels is to reduce the availability of two-way channels for BETRS in rural areas. With over 100 dedicated paging channels there can be no reasonable explanation for why paging licensees should be able to license two-way channels, in rural areas, that are critical for the provision of basic telephone service.

B. USE OF 450 MHZ TWO-WAY CHANNELS IN RURAL AREAS SHOULD BE RESTRICTED TO TWO-WAY SERVICES.

The FCC allowed the use of two-way channels for one way paging in 1989 (CC Docket 87-120).* The rationale for this action was to alleviate the scarcity of paging channels in urban areas. Further, it was noted that "[O]ur observations of the mobile services industry, as well as reports from licensees, indicate a dramatic increase in the trend for cellular service to claim much of the two-way mobile telephone traffic."** The increased demand for paging in urban areas and the growth of the cellular service combined to convince the Commission that one-way use of these paired channels was in the public interest.

IMM supported this change. However, we pointed out the need to restrict the paging use of these valuable two-way channels to major urban areas where the market demand for paging was greatest. IMM was especially concerned about the the 26 channels

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* See First Report and Order, 4 FCC Rcd 1576 (1989).

** Id. at para. 30.

at 450 MHz that support the bulk of the BETRS service in rural America. The Commission, however, did not restrict the paging use to urban areas and the result has been increased licensing and use of these channels in less urban areas.

In addition to the nearly 100 dedicated paging channels available for paging licensees the Commission has taken other actions to satisfy the demand for paging. In the flexible cellular proceeding,(CC Docket 87-390) *the Commission provided cellular licensees with the flexibility to provide paging on cellular frequencies. Recently, in the PCS proceeding (Gen. Docket 90-314 and ET Docket 92-100) the Commission authorized the use of frequencies at 930-931 MHz for advanced messaging. This service will be nationwide in scope and thus will provide coverage throughout the country to include rural areas.

There appears to be no marketplace rationale for allowing paging licensees access to the 26 two-way channels at 450 MHz which are effectively the only method for providing BETRS in rural areas.

The competition for the few channels available for BETRS can only be resolved by adopting a rule that specifically prohibits paging use of these two-way channels in rural areas.

Absent a suspension of paging licensing on these channels, some action must be taken to reduce the potential for interference. Paging use of these frequencies have increased the

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* 3 FCC Rcd 7033 (1988)

occurrence of interference between the low-powered BETRS and high-powered paging systems. There are certain actions that the Commission could take that would assist in reducing inter-service interference between paging and BETRS licensees.

B. PROPOSED RULE CHANGES

[All of the following changes apply only to rural areas.]

1. Part 22.367 Antenna Polarization

The proposed rule requires that base stations and subscriber stations in BETRS use vertically polarized antennas.

Due to interference to BETRS from higher power land mobile and paging stations, and the interference protection provided by cross polarization, IMM suggests that:

a. Horizontal polarization be specified for all future BETRS systems at 450 MHz.

b. That horizontal polarization be used exclusively by BETRS systems.

2. Part 22.507 Number of Transmitters per Station

The proposed rule Part 22.507(a) requires "each station must comprise at least one separate and dedicated transmitter ... for each transmitting channel".

IMM suggests that the rule be revised to permit the use of broadband power amplifiers common to up to 24 channels at the base station.

3. Part 22.569 Additional Channel Policies

Telephone companies must have the flexibility to plan for BETRS installations. Accordingly, the restriction of applying for only two channels should not be applied to BETRS. If spectrum is not available to satisfy the total BETRS requirement then initial installation will not proceed.

Recommend BETRS be excluded from this restriction.

4. Part 22.565 Transmitting Power Limits

The proposed rule 22.565(a) permits a maximum ERP of 3,500

watts for the 454-455 MHz base to mobile and 150 watts for the 459-460 mobile to base.

IMM suggests that the maximum ERP be restricted to 50 watts for the band 454-460 MHz in rural areas to ease the interference and spectrum congestion in this band.

5. Part 22.567(a)(5) Technical Channel Assignment Criteria

Note: Appendix A & B provide technical details related to the recommendation in this part.

The proposed rule for UHF service contour would be HAAT = 500 feet and ERP = 24 watts and service contour limited to 10 miles.

IMM suggests that since subscriber antenna heights in BETRS are typically 30 ft. as compared to 6 ft. for mobile subscribers, and subscriber antenna gains are typically 8 dBd as compared to 0 dBd for mobile subscribers, the service contours for BETRS in the 450 MHz band be 25 miles; HAAT = 500 ft. and ERP = 24 watts

6. Part 22.567(a)(6) UHF Interfering Contour

Note: Appendix C provides the analysis to support the following recommendation.

The proposed rule for HAAT = 500 ft. and ERP = 24 watts sets the interference contour at 30 miles.

IMM suggests the interference contour be 85 miles. This implies a spacing of 110 miles between co-channel BETRS base stations, both with ERP = 24 watts and HAAT = 500 ft.

The proposed rule for HAAT = 500 ft. and ERP = 500 watts sets the interference contour at 47 miles.

IMM suggests that the interference contour be 115 miles. This implies a spacing of 140 miles between a BETRS base station and a 500 watt pager or other land mobile station.

6. Part 22.813 Technical Assignment Criteria

The 12 4450 MHz channels immediately adjacent to the BETRS shared channels are the best candidate for spectrum relief for BETRS. The recent discrete allocation of 4 MHz for commercial air-ground service in Docket 88-96* will result in a competitive marketplace for all air-ground telephone

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* 6 FCC Rcd 4582 (1991)

service to include that serving private aviation. As the nationwide air-ground licensees expand their service it is reasonable to assume that the use of 450 MHz air-ground will diminish. Furthermore, any expansion of existing 450 MHz air-ground service would complicate any future sharing arrangement between BETRS and air-ground licensees. Accordingly, it would be ill-timed to expand the existing 450 MHz air-ground service at this time.

Recommend the Commission defer action on the 450 MHz air-ground rules until the impact on BETRS can be determined.

7. Part 22.313 Station Identification

Add as subparagraph (4) BETRS subscriber stations.

The majority of BETRS systems are spectrum efficient digital TDM/TDMA systems. Subscriber identification of the fixed subscribers are provided by discrete telephone numbers maintained by the licensee.

III CONCLUSION

BETRS systems have brought cost-effective and high-quality basic telephone service to many rural areas in the 4 1/2 years since its beginning. However, the licensing of paging in rural areas on the two-way channels at 450 MHz jeopardizes the continued growth of BETRS for two reasons: channel availability because of competition between two-way BETRS and one way paging and inter-service interference.

The technical changes proposed by IMM could help alleviate the potential for high power pagers to interfere with existing BETRS subscribers. However, only a complete suspension of future paging licenses on these channels in rural areas will solve the problem of competition between BETRS and paging for the scarce 450 MHz channels. Some future spectrum relief may be available in expanding the sharing arrangement to the adjacent 450 MHz air-ground channels. With adequate geographical separation, BETRS and

air-ground services could co-exist interference-free. However, if licensing of these channels is expanded, geographical sharing would be unachievable.

There are nearly a hundred discrete paging channels nationwide and only 26 shared channels in rural areas for BETRS. The provision of basic telephone service in rural areas is in the public interest and because radio is used only if more appropriate than wire, BETRS may be the only way to provide this basic service in rural areas.

Accordingly, IMM requests the Commission view BETRS as a unique and vital basic service for rural America and provide specific rules, in rural areas, to ensure its continued viability. The technical rules identified in this filing will provide some near term relief while the suspension of paging on 450 MHz in rural areas would guarantee that the few channels available at 450 MHz would be put to their most deserving use.

Respectfully submitted,

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September 29, 1992

Its Attorney

APPENDIX A

Part 22.567(a)(5) Technical Channel Assignment Criteria

The basis for proposing the 25 mile UHF service contour for:

HAAT = 500 ft. = 152.4M
ERP = 24 watts = -16 dBk

is derived from Part 73.699 Fig. 10(b) as follows:

Minimum Received Signal Level at Subscriber = -90 dBm
Subscriber Antenna Gain Less Cable Loss = + 8 dBd
Received Signal Level in Half Wave Dipole = -98 dBm

From Appendix B, the field strength in dBu at 450 MHz is:

F (dBu)= 128 +p

Where p = Received Signal Level in dBm

F = 128 - 98 = 30

This is the field strength for ERP = -16 dBk

The field strength for 0 dBk is:

F = 30 + 16 = 46 dBu

Now using Part 73.699 Fig. 10(b) for

H = 152.4M
F = 46 dBu

Distance is found to be 40 km (25 miles)

APPENDIX B

From FCC Report No. R-6406, the RF field strength E in microvolts/meter is related to power received by a half wave dipole P_R in watts by:

$$E = (P_R F^2/3.12 \times 10^{-11})^{1/2}$$

Where F = frequency in MHz

Or in dBu = dB above 1 microvolt/meter by:

$$20 \text{ Log } E = 105 + 10 \text{ Log } P_R + 20 \text{ Log } F$$

For p = Received Power in dBm, we have

$$20 \text{ Log } E = 75 + p + 20 \text{ Log } F$$

For F = 450 MHz, this becomes

$$20 \text{ Log } E = 128 + p.$$

APPENDIX C

Part 22.567(a)(6) UHF Interfering Contour

The following analysis shows that for worst configuration, co-channel BETRS base stations should be spaced 110 miles apart: This is based on BETRS base station ERP = 24 watts and HAAT = 500 ft.

Similar analysis shows that a spacing of 140 miles should be used between a BETRS base station and a 500 watt pager or land mobile base station with HAATs = 500 ft.

In Section A, the co-channel BETRS base stations are considered. In A-1, interference at the BETRS subscriber from the undesired BETRS base station is treated. In A-2, interference at the BETRS base station from the undesired BETRS subscriber is considered.

In Section B, the co-channel BETRS base and pager/mobile base cases are considered. In B-1, interference at the BETRS subscriber from the undesired base is treated. In B-2, interference at the BETRS base station from the mobile is considered.

I. SYSTEM PARAMETERS AND ASSUMPTIONS

A. FM System

1. Frequencies

Base Station	454.825 ... .650 MHz
Mobile	459.025 ... .650 MHz

2. Effective Radiated Power (ERP)

Base Station	500 Watts (+57 dBm)
Mobile	60 Watts (+48 dBm)

3. Base Station HAAT = 500 ft.

4. Service Contour = 15 miles

5. Mobile Antenna Height = 6 ft.

B. BETRS System

1. Frequencies

Base Station	454.825 ... .650 MHz
Mobile	459.025 ... .650 MHz

2. Effective Radiated Power (ERP)

Base Station	24 Watts (+44 dBm) Peak
Mobile	12 Watts (+41 dBm) Peak

3. Base Station HAAT = 500 ft.

4. Service Antenna Height = 30 ft.

5. Service Contour = 25 miles

6. Carrier-to-Interference Ratio Required:

FM Interferer:	26 dB
Ultraphone Interferer:	23 dB

II. ANALYSIS

A-1. BETRS Base/BETRS Base Station Co-Channel Interference

Refer to Figure #1

The BETRS subscriber receives a desired signal C from base station A and an interfering signal from base station B.

The ratio C/I is calculated from:

$C/I = 20 \text{ Log } (D_I/D_C) + L - FM + A$

D_I = Distance Sub to Interferer B = 85 miles

D_C = Distance Sub to Base A = 25 miles

L = Over-the-Horizon Loss for Interference

FM = Allowance for down fading desired signal, upfading interferer, and variation of median path losses for specific paths = 29 dB (assumed)

A = Front-to-Back Ratio Subscriber Antenna = 14 dB (assumed)

The radio horizon for the base station antenna at a height of 500 ft. is:

$$D_H = \sqrt{2 \times 500} = 31.6 \text{ miles}$$

The radio horizon for the subscriber antenna at a height of 30 ft. is:

$$D_S = \sqrt{2 \times 30} = 7.7 \text{ miles}$$

The combined horizon is:

$$D = D_H + D_S = 39.3 \text{ miles}$$

The interference path from base station B to the sub is 85 miles long. This is an over-the-horizon path of (85-39) = 46 miles.

The over-the-horizon loss is estimated to be:

$L = 60 \text{ Log } (D) - 67$

$= 60 \text{ Log } 46 - 67$

$= 32$ dB (annual median)

Thus:

$$C/I = 20 \text{ Log } (85/25) + 32 - 29 + 14$$
$$= 27 \text{ dB.}$$

The required C/I for BETRS with 16 DPSK modulation is 23 dB.

The requirement is met and no interference is expected from this source.

A-2. <u>BETRS Subscriber/BETRS Subscriber Co-Channel Interference</u>
Refer to Figure #2

BETRS base station A receives a desired subscriber signal C and an interfering subscriber signal I.

The ratio C/I is calculated as in A-1.

$C/I = 20 \text{ Log } (D_I/D_C) + L - FM + A$
D_I = Distance Interferer Sub From Base A = 85 miles
D_C = Distance Desired Sub From Base A = 25 miles
L = Over-the-Horizon Loss = 32 dB
FM = 29 dB
A = 14 dB

Thus:

$$C/I = 20 \text{ Log } (85/25) = 32 - 29 + 14$$
$$= 27 \text{ dB}$$

As in A-1, the requirement of 23 dB is met and no interference is expected from this source.

B-1. <u>BETRS Base/Mobile Base Station Co-Channel Interference</u>
Refer to Figure #3

The BETRS subscriber receives a desired signal C from base station A and an interfering signal mobile base station B.

The ratio C/I is calculated from:

$$C/I = ERP_C - ERP_I + 20 \text{ Log } (D_I/D_C) + L - FM + A$$

ERP_C = ERP BETRS Base = +44 dBm
DRP_I = ERP Mobile Base = +57 dBm
D_I = Distance Sub to Mobile Base B = 115 miles
D_C = Distance Sub to Base A = 25 miles
L = Over-the-Horizon Loss for Interference
FM = 29 dB
A = 14 dB
D_I = 115 miles
D = 39 miles
Over Horizon = 76 miles
L = 45 dB (annual median)

C/I is then determined to be:

$$C/I = 44 - 57 + 20 \text{ Log } (115/25) = 45 - 29 + 14$$
$$= 36 \text{ dB}$$

The required C/I for BETRS with 16 DPSK modulation and FM interference is 26 dB.

The requirement is met and no interference is expected from this source.

B-2. <u>BETRS Subscriber/Mobile Co-Channel Interference</u>
Refer to Figure #4

BETRS base station A receives a desired signal C from the BETRS subscriber and an interfering signal I from the mobile.

The ration C/I is:

$$C/I = ERP_C - ERP_I + 20 \text{ Log } (D_I/D_C) + L - FM$$

Where ERPC = ERP BETRS Sub = +41 dBm
ERPI = ERP Mobile = +48 dBm
DI = Distance Mobile From BETRS Base A = 125 miles
DC = Distance BETRS Sub from BETRS Base A = 25 miles
L = Over-the-Horizon Loss for Interference

The radio horizon for the mobile antenna at 6 ft is assumed to be:

$$DM = \sqrt{2 \times 6} = 3.5 \text{ miles}$$

The combined radio horizon is then 35 miles.

The over-the-horizon path length is (125-35) = 90 miles

L = 50 dB (annual median)
FM = 29 dB

From which:

C/I = 41 - 48 + 20 Log (125/25) + 50 - 29

= 28 dB.

The required C/I = 26 dB is met and no interference is expected from this source.

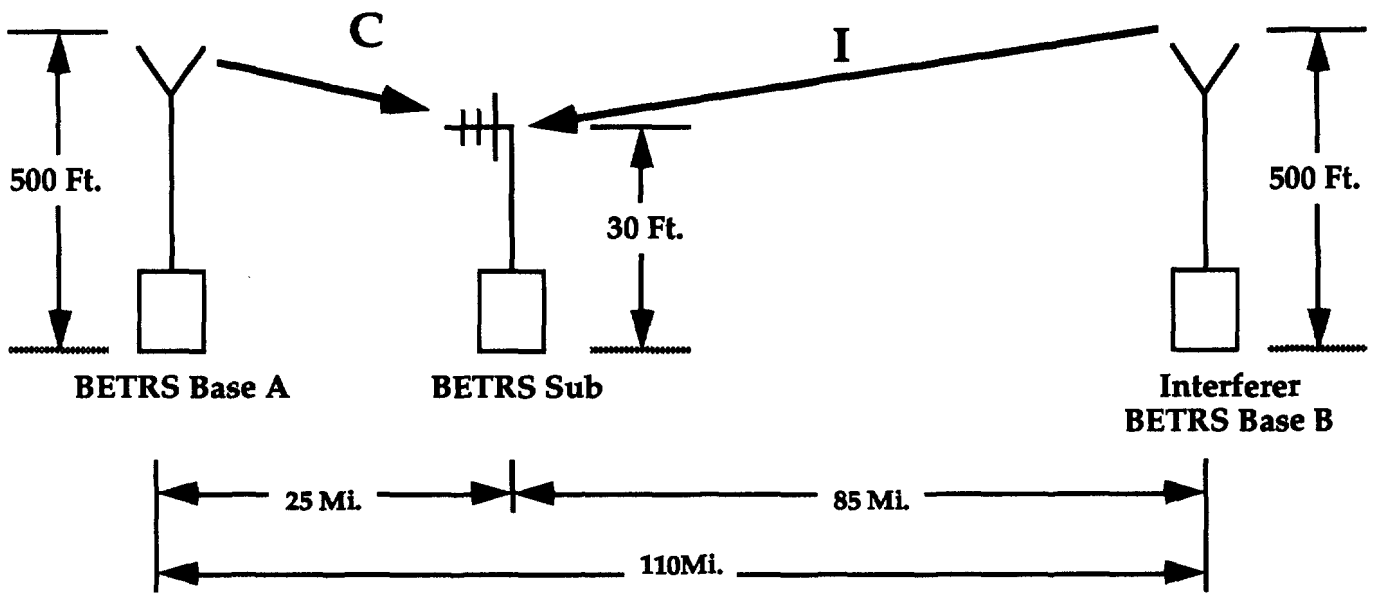

Figure #1 BETRS Base/BETRS Base Interference

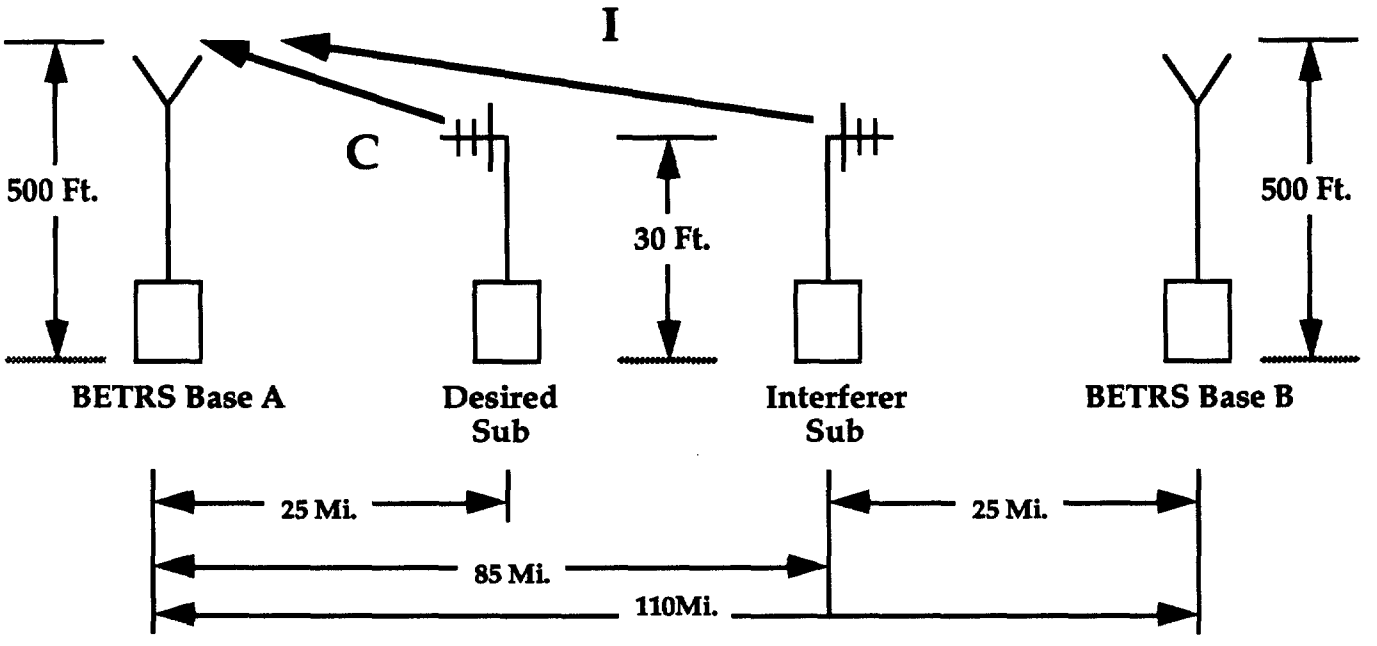

Figure #2 BETRS Sub/BETRS SubInterference

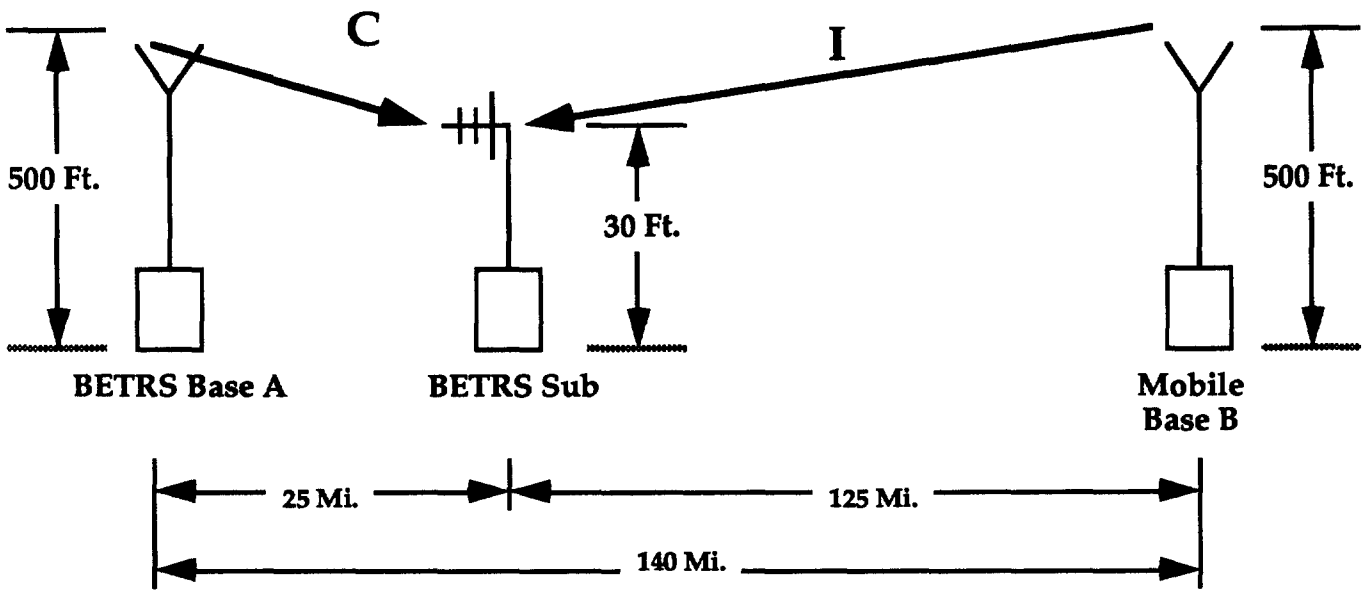

Figure #3 BETRS Base/Mobile Base Interference

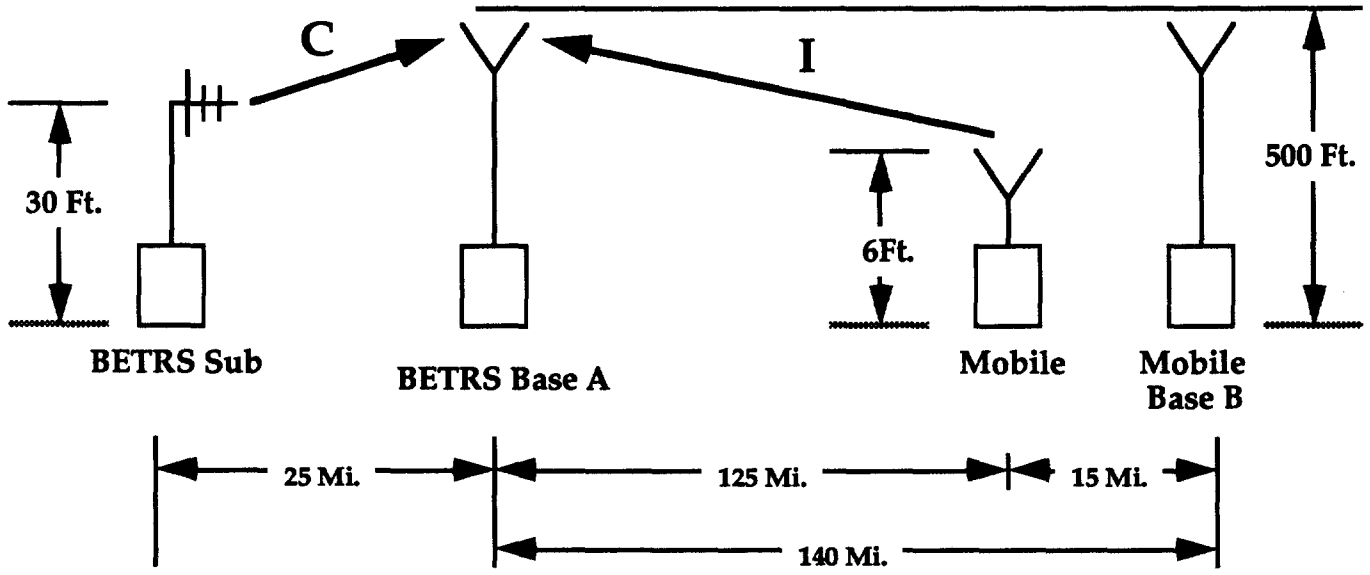

Figure #4 BETRS Sub/Mobile Interference